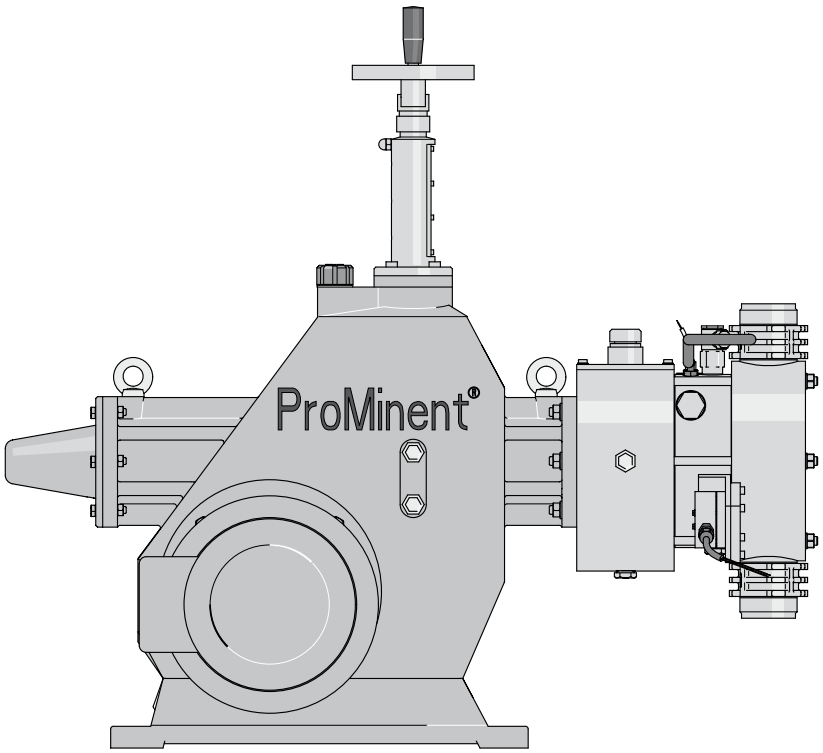
Operating instructions

Hydraulic diaphragm metering pump

ProMinent® Makro/ 5 M5Ha



Two sets of operating instructions are required for the safe, correct and proper operation of the metering pumps: The product-specific operating instructions and the "General Operating Instructions for ProMinent® motor-driven metering pumps and hydraulic accessories".

Both sets of operating instructions are only valid when read together.

Please carefully read these operating instructions before use! · Do not discard!
The operator shall be liable for any damage caused by installation or operating errors!
Technical changes reserved.

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Supplementary information

Fig. 1: Please read!

Read the following supplementary information in its entirety! Should you already know this information, you have an even greater need of the Operating Instructions.

The following are highlighted separately in the document:

- Enumerated lists

→ Instructions

⇨ Outcome of the handling instructions

- see (reference)

Information

This provides important information relating to the correct operation of the device or is intended to make your work easier.

Safety notes

Safety notes are identified by pictograms - see Safety Chapter.

General user instructions

Two sets of operating instructions are required for the safe, correct and proper operation of the metering pumps: The product-specific operating instructions and the "General Operating Instructions for ProMinent® motor-driven metering pumps and hydraulic accessories".

Both sets of operating instructions are only valid when read together.

Please read these operating instructions carefully before use! Do not discard!

State the identity code and serial number

Please state identity code and serial number, which you can find on the nameplate when you contact us or order spare parts. This enables the device type and material versions to be clearly identified.

General non-discriminatory approach

In order to make it easier to read, this document uses the male form in grammatical structures but with an implied neutral sense. It is aimed equally at both men and women. We kindly ask female readers for their understanding in this simplification of the text.

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1 Identity code

M5Ha	Makro/ 5 hydraulic diaphragm metering pump									
	Power end type									
	H	Main power end								
	D	Main power end, doubled								
	A	Add-on power end								
	B	Add-on power end doubled								
		Type*								
		250450	160616 120716 120919 101345 062305							
		250562	160770 120895 121148 101680 062880							
		250772	161058 121229 121577 102310 063960							
		250997	161366 121588 122037 102980 065110							
		251170	161602 121862 122389 103500 066000							
			Dosing head material							
			PC	PVC						
			PP	Polypropylene						
			TT	PTFE + 25 % carbon						
			SS	Stainless steel						
				Seal material						
				T	PTFE					
					Displacement body material					
					T	Metering diaphragm with PTFE coating				
						Dosing head version				
						1	With valve spring			
							Hydraulic connector			
							0	Standard connection		
							1	Union nut and PVC insert		
							2	Union nut and PP insert		
							3	Union nut and PVDF insert		
							4	Union nut and SS insert		
								Version		
								0	With ProMinent® logo, no frame	
								1	Without ProMinent® logo, no frame	
								A	With ProMinent® logo, with single frame	
								B	With ProMinent® logo, with double frame	
								C	With ProMinent® logo, with triple frame	
								D	With ProMinent® logo, with quadruple frame	
								M	Modified*	* order-related version, for pump features see order paperwork
									Electric power supply	
									S	3 ph, 230 V/400 V 50/60 Hz (WBS)

M5Ha	**Makro/ 5 hydraulic diaphragm metering pump**												
									L	3 ph, 460 V, 60 Hz, (Exe, Exd)			
									P	3 ph, 230 V/400 V 50 Hz (Exe, Exd)			
									R	Variable speed motor 4 pole, 230/400 V (R 1:5)			
									N	1 ph, 115 V, 60Hz			
									V(0)	Motor with integral Frequency converter			
									V(2)	Motor with integral frequency converter (Exd)			
									5	No motor, with gear IEC 100			
									6	No motor, with gear IEC 112			
									0	No motor, no gear			
										Motor version			
										0	IP 55 (Standard) ISO class F		
										1	Exe version ATEX-T3		
										2	Exd version ATEX-T4		
										A	Power end ATEX design		
											Stroke sensor		
											0	No stroke sensor	
											1	Stroke sensor (Namur), intrinsically safe	
												Stroke length adjustment	
												0	Stroke length adjustment, manual
												3	Control drive 230 V 0-20 mA
												4	Control drive 230 V 4-20 mA
												5	Control drive 115 V 0-20 mA
												6	Control drive 115 V 4-20 mAz
													Applications
													0 standard
													3 low temperature -25 °C

* Material versions PC/PP/TT max. 10 bar

2 About this pump

All pumps

The ProMinent® Makro/ 5 hydraulic diaphragm metering pump is fitted as standard with a 3 kW wide range AC motor. The stroke length can be adjusted between 0...50 mm. The spheroidal graphite housing can be combined with up to 25 liquid end sizes and 5 gear reduction ratios (integrated in the spur geared motor). The liquid ends are available in various material combinations which can be matched to the feed chemicals being metered.

Externally mounted pumps

The ProMinent® Makro/ 5 externally mounted metering pump can be combined with the Makro/ 5 main power end to form a double or multiple pump. A main power end can be combined with up to four add-on power ends. One power end can be used both as a single or a double head version.

Double head version

The double head versions are fitted with a second liquid end which operates in push-pull mode (Boxer principle).

3 Safety chapter

Identification of safety notes

The following signal words are used in these operating instructions to denote different severities of danger:

Signal word	Meaning
WARNING	Denotes a possibly dangerous situation. If this is disregarded, you are in a life-threatening situation and this can result in serious injuries.
CAUTION	Denotes a possibly dangerous situation. If this is disregarded, it could result in slight or minor injuries or material damage.

Warning signs denoting different types of danger

The following warning signs are used in these operating instructions to denote different types of danger:

Warning signs	Type of danger
	Warning – hand injuries.
	Warning – high-voltage.
	Warning – flammable substances.
	Warning – hot surface.
	Warning – danger zone.

Correct and proper use

- The pump may only be used to meter liquid metering chemicals.
- In potentially explosive atmospheres in zone 1, device category II 2G of explosion group II C, the pump must only be operated according to the with the relevant nameplate (and the respective EC Declaration of Conformity) for pumps for potentially explosive atmospheres complying with Directive 94/9/EC in accordance with the European guidelines. The explosion group, category and degree of protection identified on the marking must correspond with or be better than the given conditions in the intended field of application.
- The pump may only be started up after it has been correctly installed and commissioned in accordance with the technical data and specifications contained in the operating instructions.
- The general limitations with regard to viscosity limits, chemical resistance and density must be observed - see also ProMinent resistance list (In the product catalogue or at *www.prominent.com*)!
- Any other uses or modifications are prohibited.
- Pumps without the relevant nameplate (and the respective EC Declaration of Conformity) for pumps for potentially explosive atmospheres must never be operated in potentially explosive atmospheres.

- The pump is not intended for the metering of gaseous media or solids.
- The pump is not intended for unprotected outside use.
- The pump is only approved to meter flammable liquids, if the operator takes appropriate safety measures.
- The pump should only be operated by trained and authorised personnel, see also *'Qualification of personnel' on page 9*.
- You are obliged to observe the information contained in the operating instructions at the different phases of the device's service life.

In hazardous locations only the following combinations of identity code variants is permitted:

Combi-nations	Identity code specification	values
1	Electric power supply	L, P
	Motor version	1,2, V(2)
	Stroke length adjustment	0, G, H
2	Electric power supply	0, 5.6
	Motor version	A
	Stroke length adjustment	0, G, H

Qualification of personnel

Activity	Qualification level
Storage, transport, unpacking	Instructed person
Assembly, installation of hydraulic system	Technical personnel, service
Installation, electrical	Electrical technician
Operation	Instructed person
Maintenance, repair	Technical personnel, service
Decommissioning, disposal	Technical personnel, service
Troubleshooting	Technical personnel, electrical technician, instructed person, service

Explanation of the terms:

Technical personnel

A qualified employee is deemed to be a person who is able to assess the tasks assigned to him and recognise possible dangers based on his/her technical training, knowledge and experience, as well as knowledge of pertinent regulations.

Note:

A qualification of equal validity to a technical qualification can also gained by several years employment in the relevant work area.

Electrical technician

Electrical technicians are deemed to be people, who are able to complete work on electrical systems and recognize and avoid possible dangers independently based on their technical training and experience, as well as knowledge of pertinent standards and regulations.

Electrical technicians should be specifically trained for the working environment in which the are employed and know the relevant standards and regulations.

Electrical technicians must comply with the provisions of the applicable statutory directives on accident prevention.

Instructed person

An instructed person is deemed to be a person who has been instructed and, if required, trained in the tasks assigned to him/her and possible dangers that could result from improper behaviour, as well as having been instructed in the required protective equipment and protective measures.

Service

Customer Service department refers to service technicians, who have received proven training and have been authorised by ProMinent or ProMaqua to work on the system.

Safety notes

WARNING!

Warning of dangerous or unknown feed chemical

Should a dangerous or unknown feed chemical be used: It may escape from the hydraulic components when working on the pump.

- Take appropriate protective measures before working on the pump (e.g. safety glasses, safety gloves, ...). Observe the safety data sheet for the feed chemical.
- Drain and flush the liquid end before working on the pump.

WARNING!

Danger from hazardous substances!

Possible consequence: Fatal or very serious injuries.

Please ensure when handling hazardous substances that you have read the latest safety data sheets provided by the manufacture of the hazardous substance. The actions required are described in the safety data sheet. Check the safety data sheet regularly and replace, if necessary, as the hazard potential of a substance can be re-evaluated at any time based on new findings.

The system operator is responsible for ensuring that these safety data sheets are available and that they are kept up to date, as well as for producing an associated hazard assessment for the workstations affected.

CAUTION!

Warning of feed chemical spraying around

Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.

- Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
- Depressurise the system before commencing any work on hydraulic parts.

CAUTION!

Warning of feed chemical spraying around

An unsuitable feed chemical can damage the parts of the pump contacted by the chemical.

– Take into account the resistance of the materials which will come into contact with the chemical when selecting the feed chemical - see the ProMinent product catalogue or under *www.prominent.com*.

CAUTION!

Danger of personnel injury and material damage

The use of untested third party parts can result in personnel injuries and material damage.

– Only fit parts to metering pumps, which have been tested and recommended by ProMinent.

CAUTION!

Danger from incorrectly operated or inadequately maintained pumps

Danger can arise from a poorly accessible pump due to incorrect operation and poor maintenance.

– Ensure that the pump is accessible at all times.
– Adhere to the maintenance intervals.

CAUTION!

Warning of illegal operation

Observe the regulations that apply where the unit is to be installed.

Information in the event of an emergency

In the event of an electrical accident, disconnect the mains cable from the mains or press the emergency cut-off switch fitted on the side of the system!

If feed chemical escapes, also depressurise the hydraulic system around the pump as necessary. Adhere to the safety data sheet for the feed chemical.

Protective equipment

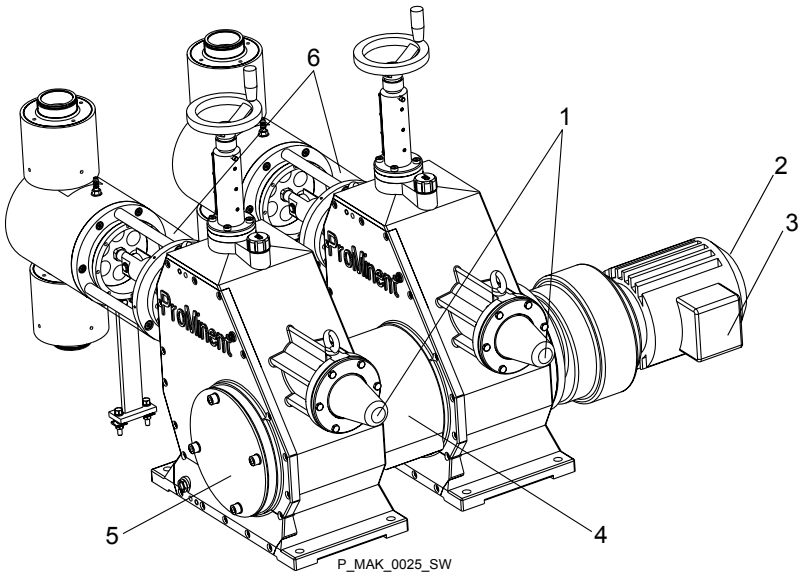

Fig. 2: Isolating protective equipment Makro/ 5 with add-on power end (shown here for piston version)

1 Cap (only single head version)
2 Fan impeller hood
3 Terminal box cover, motor
4 Cover plate (only with add-on power end)
5 Flange cover
6 Protective cover (only diaphragm and piston versions)

WARNING!

Warning of personal injury and material damage

– The customer must only remove the protective equipment if requested to do so by the operating instructions.
– The pump must not operate without fitted protective equipment.

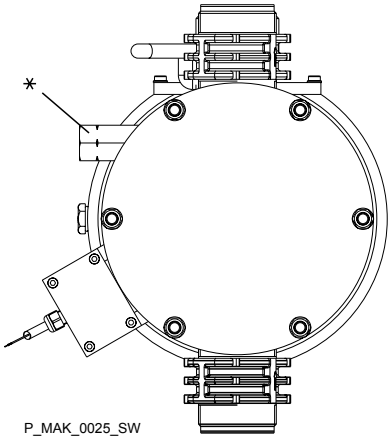

Fig. 3: M5Ha liquid end

* Safety relief valve

Sound pressure level

Sound pressure level LpA < 75 dB in accordance with EN ISO 20361:2010-10

at maximum stroke length, maximum stroke rate, maximum back pressure (water)

4 Storage, transport and unpacking

Safety notes

WARNING!

The transporting of pumps which have been used with radioactive feed chemicals is forbidden!

They will also not be accepted by ProMinent!

WARNING!

Only return metering pumps for repair in a cleaned state and with a flushed liquid end - refer to the section on decommissioning!

Only send metering pumps with a filled in Decontamination Declaration form. The Decontamination Declaration constitutes an integral part of an inspection / repair order. A unit can only be inspected or repaired when a Declaration of Decontamination Form is submitted that has been completed correctly and in full by an authorised and qualified person on behalf of the pump operator.

You can find the "Decontamination Declaration" form under *www.prominent.com* or on the CD.

CAUTION!

Danger of environmental and material damage

The unit can be damaged or oil may escape due to incorrect or improper storage or transportation!

- The unit should only be stored or transported in a well packaged state - preferably in its original packaging.
- Only transport the unit with the locking screw - not the bleed plug - fitted to the oil filling opening.
- The packaged unit should also only be stored or transported in accordance with the stipulated storage conditions.
- The packaged unit should be protected from moisture and the ingress of chemicals.

Scope of supply

Compare the delivery note with the scope of supply:

- Metering pump with mains power cable
- Connector kit for tube/pipe connection
- Product-specific operating instructions with EC Declaration of Conformity
- CD with order information, exploded diagrams, performance diagrams, motor data sheet and dimension sheets
- Optional accessories if ordered

Storage

Personnel: ■ Technical personnel

1. Place the caps on the valves.
2. Check whether the seal screw is screwed into oil filler opening instead of the vent screw.
3. Preferably place the pump standing vertically on a pallet and secure against falling over.
4. Cover the pump with a tarpaulin cover - allowing rear ventilation.

Store the pump in a dry, sealed place in the following ambient conditions.

Ambient conditions

Data	Value	Unit
Minimum storage and transport temperature	-10	°C
Maximum storage and transport temperature	+50	°C
Maximum air humidity *	95	% rel. humidity

* non-condensing

5 Overview of equipment, control elements

Power end, single head

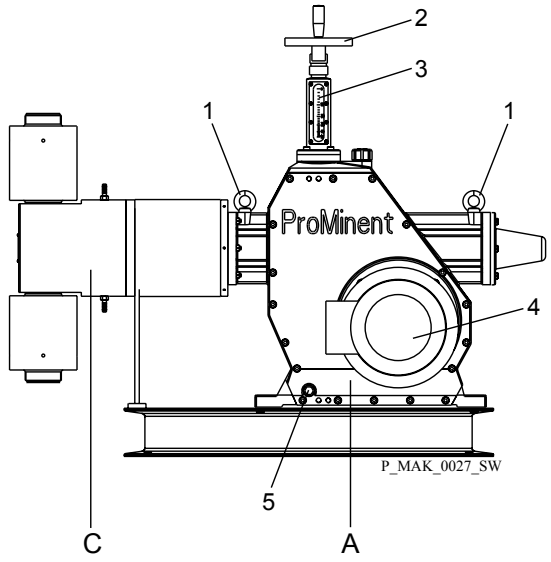

Fig. 4: View from the motor side (here M5Ka H)

A Power end
C Liquid end
1 Lifting eye
2 Stroke length adjustment wheel
3 Indicating dial
4 motor
5 Oil drain plug

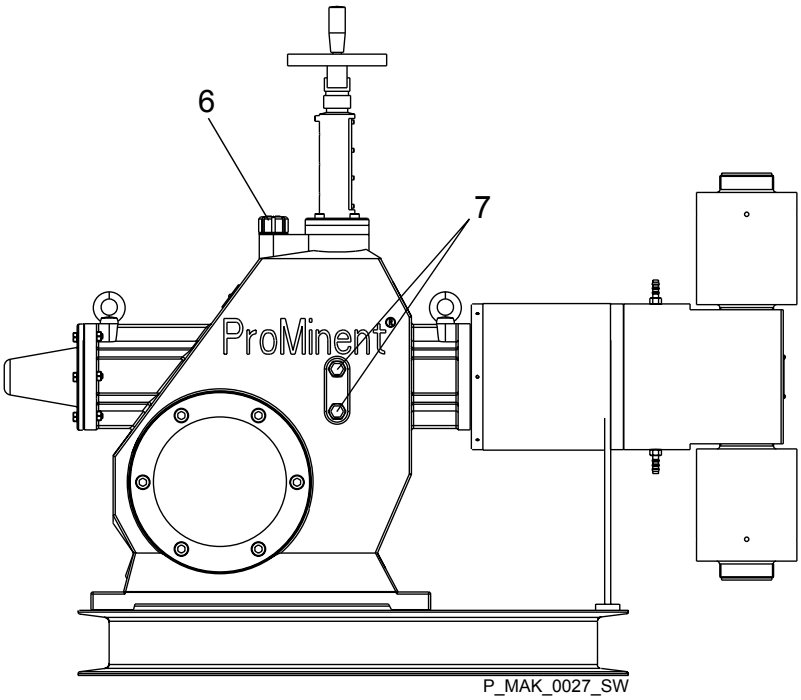

Fig. 5: View away from the motor (here M5Ka H)

6 Vent screw
7 Oil inspection window

Power end, double head

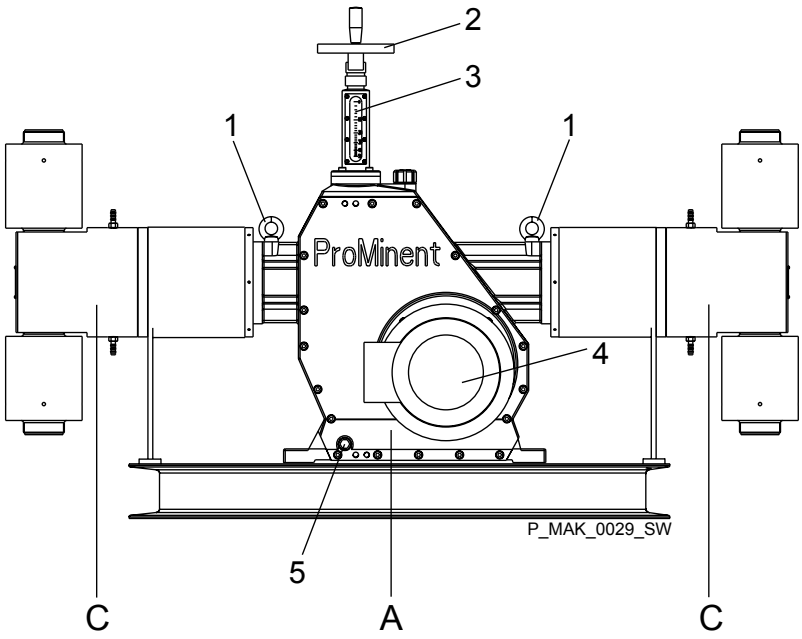

Fig. 6: View from the motor side (here M5Ka D)

A Power end
C Liquid end
1 Lifting eye
2 Stroke length adjustment wheel
3 Indicating dial
4 motor
5 Oil drain plug

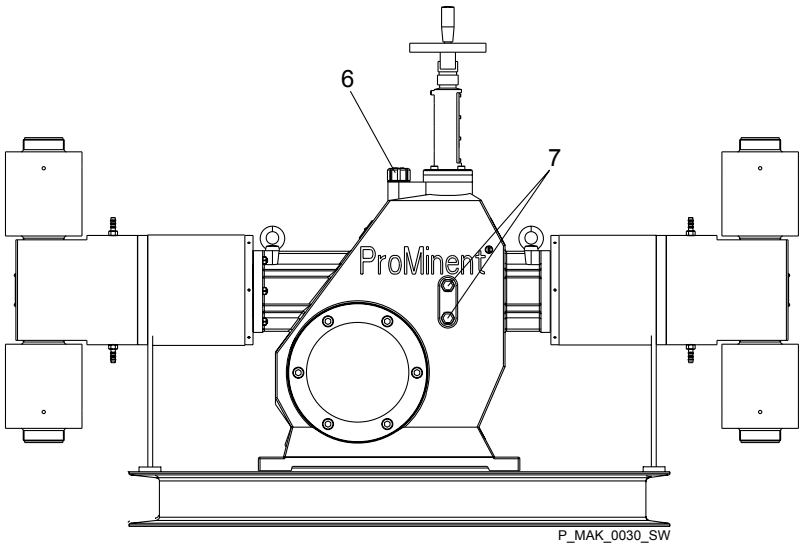

Fig. 7: View away from the motor (here M5Ka D)

6 Vent screw
7 Oil inspection window

Liquid end

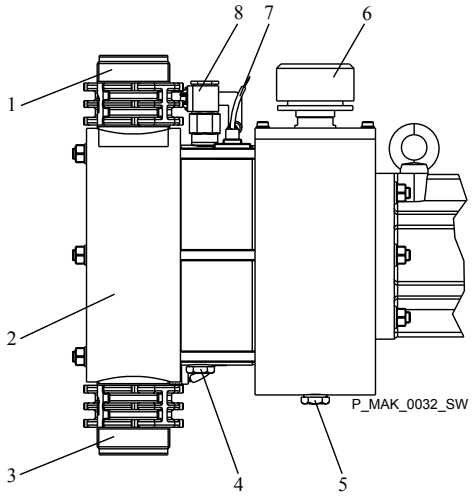

Fig. 8

1 Discharge valve
2 Dosing head
3 Suction valve
4 Oil drain plug, liquid end
5 Oil drain plug, storage tank
6 Filler opening, storage tank
7 Overpressure sensor connector
8 Bleed valve

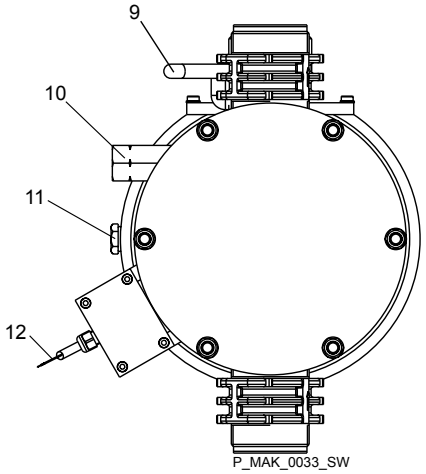

Fig. 9

1 Bleed hose
2 Pressure relief valve
3 Oil inspection window, hydraulic oil
4 Diaphragm rupture sensor connector

6 Functional description

Power end functional description

The Makro/ 5 metering pump is a motor-driven metering pump with a kinematic gear.

A motor drives the cam shaft (1). A connecting rod (2) rests on the cam shaft (1) which allows the oscillating crank (4) to rotate about a variable pivot point, see Fig. 10. The lifting arm of the oscillating crank, which lies above the pivot point, moves the slide rod (8) which itself drives the liquid end.

The stroke is adjusted using the manual adjustment wheel (7). This causes a spindle (6) to move the fork (5; shown in cutaway view in the diagram). The fork (5) moves the sliding block (3) in a groove cut into the oscillating crank (4). The sliding block (3) determines the pivot point of the oscillating crank (4). This determines the stroke length. When the pivot point of the sliding block (3) is directly above the axle of the slide rod (8) the lifting arm of the oscillating crank above the pivot point is at zero and the slide rod stops. When the sliding block (3) is pushed down, the lifting arm of the oscillating crank (4) above the pivot point is greater than zero so that the slide rod (8) is driven

Liquid ends can be fitted to both ends of the slide rod. They then operate in push-pull mode (Boxer principle).

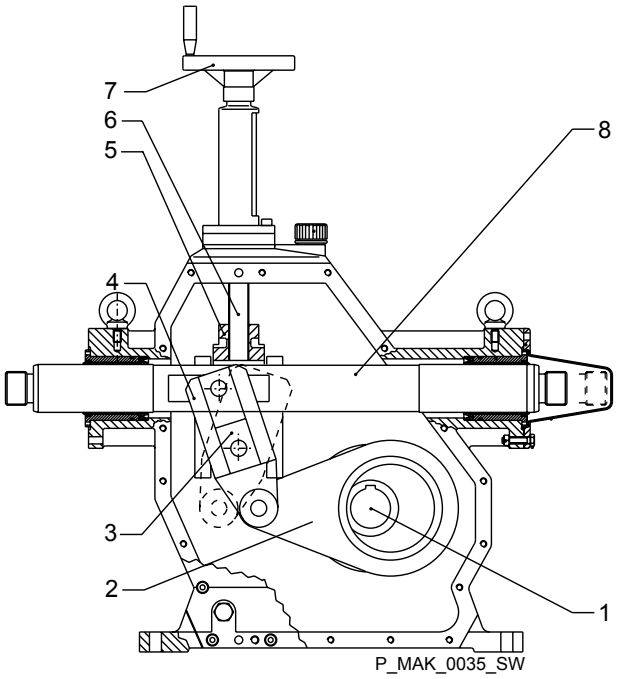

Fig. 10: Cross-section through the power end

1 Cam shaft
2 Connecting rod
3 Sliding block
4 Oscillating crank
5 Fork
6 Spindle
7 Manual adjustment wheel
8 Slide rod

Functional description liquid end (for M5Ma)

The metering pump liquid end is a liquid end with a hydraulically operated diaphragm. It is a highly resistant multi-layer diaphragm (2). It hermetically seals the delivery chamber of the dosing head (3) and produces a displacement in the doing head at each pump stroke. The suction valve (4) and the discharge valve (1) provide the feed in conjunction with the diaphragm action.

As the diaphragm is hydraulically activated - it is not attached to the piston (7) - it always works in balance with the pump and is therefore well suited to high feed pressures. Similarly to a conventional motor-driven metering pump, the motor moves the piston (7) forwards and backwards. The forward motion pushes the piston into the hydraulic end and builds up the pressure in its hydraulic oil. As a result the hydraulic oil pushes the multi-layer diaphragm (2) towards the dosing head (3).

The stroke length of the multi-layer diaphragm is adjusted by the connecting rod stroke length.

The bleed valve (10) bleeds the hydraulic end and guides the gas bubbles with a small quantity of oil into the storage tank (8). This reduces the amount of hydraulic oil in the hydraulic end and the multi-layer diaphragm (2) moves slowly towards the piston (7). If it touches the diaphragm position sensor (5), the compensation valve (9) opens and hydraulic oil is sucked out of the storage tank and consequently the diaphragm position corrected.

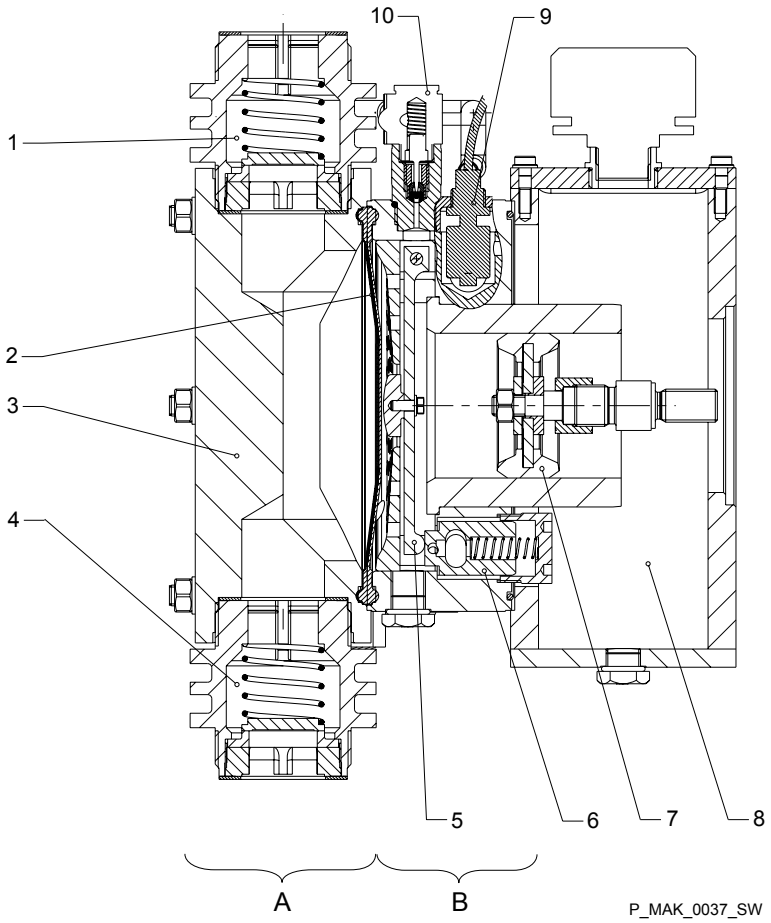

Fig. 11: Cross-section through the liquid end

A Liquid end
B Hydraulic end
1 Discharge valve
2 Multi-layer diaphragm
3 Dosing head
4 Suction valve
5 Diaphragm position sensor
6 Compensation valve (air valve)
7 Piston
8 Storage tank
9 Overpressure sensor
10 Bleed valve

The pump has a rigidly adjusted **Pressure relief valve** in the hydraulic end. The pressure relief valve protects the pump - not the system! - together with the overpressure sensor (9) and a corresponding switching of the pump in the event of too high discharge pressure (= overpressure protection). If the discharge side of the liquid end is blocked, the pressure relief valve opens at the set overpressure and allows the hydraulic oil to flow back into the storage tank (8). The overpressure sensor (9) behind the pressure relief valve then opens and its contact signal immediately switches the pump off (to be implemented by the customer!). As soon as the system is started again in the permissible pressure range, the hydraulic end fills within a few strokes via the compensation valve (6).

Diaphragm rupture warning system functional description

The diaphragm rupture warning system monitors the leak-tightness of the multi-layer diaphragm. Together with the diaphragm rupture sensor and downstream analysis electronics, the multi-layer diaphragm forms the diaphragm rupture warning system.

The multi-layer diaphragm (1) has a flap (2) to one side. As soon as an outer layer of the multi-layer diaphragm brakes, feed chemical enters into it under pressure and inflates this flap. This presses the flap on to the diaphragm rupture sensor (3), so that its contact signal immediately switches off the pump (to be implemented by the customer!).

Moreover, the multi-layer diaphragm prevents feed chemicals from mixing with hydraulic oil in event of diaphragm rupture.

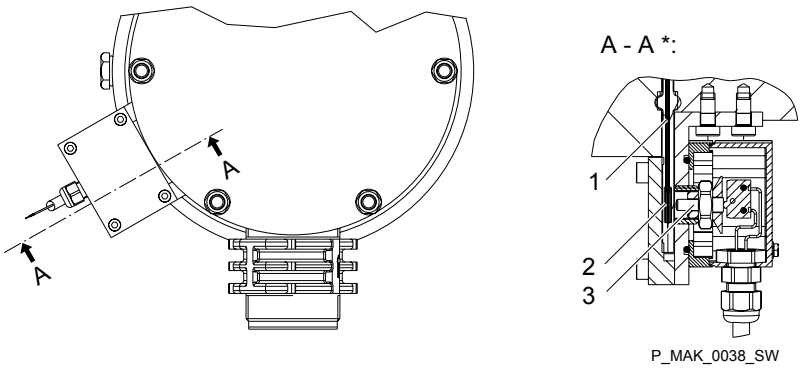

Fig. 12: Diaphragm rupture sensor

7 Assembly

Safety notes

WARNING!

Warning about personal and material damage

EX pumps only: When operating in EX areas, certain subjects must be observed.

– The chapter "Important supplements for metering pumps in EX zones" of the "General Operating Instructions on ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories" must be observed in all cases.

CAUTION!

Warning about personal and material damage

Also observe the "General Operating Instructions for ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories"!

CAUTION!

Danger of environmental and material damage

The unit can be damaged or oil may escape due to incorrect or improper storage or transportation!

– The unit should only be stored or transported in a well packaged state - preferably in its original packaging.
– Only transport the unit with the locking screw - not the bleed plug - fitted to the oil filling opening.
– The packaged unit should also only be stored or transported in accordance with the stipulated storage conditions.
– The packaged unit should be protected from moisture and the ingress of chemicals.

CAUTION!

Warning about personal and material damage

Personal and material damage may be caused if the unit is operated outside of the permissible ambient conditions.

– Please observe the permissible ambient conditions - refer to the chapter entitled "Technical Data".

Supporting floor

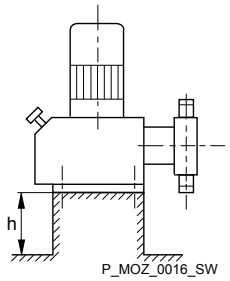

Fig. 13

WARNING!

Risk of electric shock

If water or other electrically conducting liquids penetrate into the drive housing, an electric shock may occur.

– Position the pump so that drive housing cannot be flooded.

WARNING!

The pump can break through the supporting floor or slide off it

– The supporting floor must be horizontal, smooth and permanently load-bearing.

Capacity too low

Vibrations can disturb the valves of the liquid end.

– *The supporting floor must not vibrate.*

Space requirement

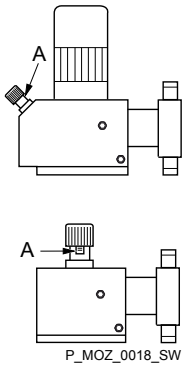

Fig. 14

CAUTION!

Danger from incorrectly operated or inadequately maintained pumps

Danger can arise from a poorly accessible pump due to incorrect operation and poor maintenance.

– Ensure that the pump is accessible at all times.
– Adhere to the maintenance intervals.

Position the pump so that control elements such as the stroke length adjustment knob, the indicating dial A or the oil inspection window are accessible.

In so doing, ensure there is enough space to carry out an oil change (vent screws, oil drain plugs, oil trough ...).

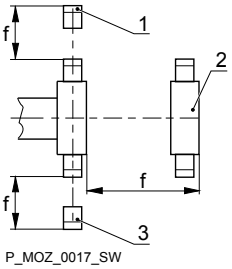

Fig. 15

1 Discharge valve
2 Dosing head
3 Suction valve

Ensure there is sufficient free space (f) around the dosing head as well as the suction and discharge valve so that maintenance and repair work can be carried out on these components.

Liquid end alignment

Capacity too low

If the valves of the liquid end do not stand upright, they cannot close correctly.

– *The discharge valve must be upright.*

Fastening

Capacity too low

Vibrations can disturb the valves of the liquid end.

– *Secure the metering pump so that no vibrations can occur.*

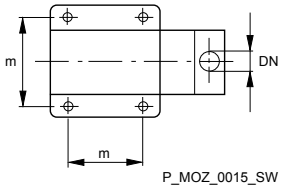

Fig. 16

Take the dimensions (m) for the fastening holes from the appropriate dimensional drawings or data sheets.

Fasten the pump base to the supporting floor using suitable screws.

Instruction

→ Screw the pump to a support surface with 4 sufficiently strong screws through the 4 holes in the frame.

Nothing more need be fitted to the pump itself: the pump is filled with gear oil and completely assembled on a frame.

8 Installation

CAUTION!

Danger of personnel injury and material damage

The disregard of technical data during installation may lead to personal injuries or damage to property.

– Observe the technical data- refer to chapter "Technical Data" and, where applicable, the operating instructions of the accessories.

8.1 Installation, hydraulic

WARNING!

Warning about personal and material damage

EX pumps only: When operating in EX areas, certain subjects must be observed.

– The chapter "Important supplements for metering pumps in EX zones" of the "General Operating Instructions on ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories" must be observed in all cases.

WARNING!

Warning of feed chemical reactions to water

Feed chemicals that should not come into contact with water may react to residual water in the liquid end that may originate from works testing.

– Blow the liquid end dry with compressed air through the suction connector.
– Then flush the liquid end with a suitable medium through the suction connector.

WARNING!

The following measures are an advantage when working with highly aggressive or hazardous feed chemicals:

– Install a bleed valve with recirculation in the storage tank.
– Install an additional shut-off valve on the discharge or suction ends.

CAUTION!

Warning about personal and material damage

Also observe the "General Operating Instructions for ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories"!

CAUTION!

Suction problems possible

For feed chemicals with a particle size greater than 0.3 mm, the valves may no longer close properly.

– Install a suitable filter in the suction line.

CAUTION!

Warning against the discharge line bursting

With a closed discharge line (e.g. due to a clogged discharge line or by closing a valve), the pressure that the metering pump generates can reach several times the permissible pressure of the system or the metering pump. This could lead to lines bursting resulting in dangerous consequences with aggressive or toxic feed chemicals.

– Install a relief valve that limits the pressure of the pump to the maximum permissible operating pressure of the system.

CAUTION!

Warning against the discharge line bursting

Tube lines with insufficient pressure rating may burst.

– Only use tube lines with the required pressure rating.

CAUTION!

Warning against lines disconnecting

With suction, discharge and relief lines installed incorrectly can loosen / disconnect from the pump connection.

– Only use original tubing with the specified tube diameter and wall thickness.
– Only use clamp rings and tube nozzles that correspond with the respective hose diameter.
– Always connect the lines without mechanical tension.

– *Precise metering is only possible when the back pressure is maintained above 1 bar at all times.*
– *If metering at atmospheric pressure, a back pressure valve should be used to create a back pressure of approx. 1.5 bar.*

Personnel: ■ Technical personnel

8.2 Installation, electrical

WARNING!

Danger of electric shock

Unprofessional installation may lead to electric shocks.

– All cable cores cut to length must be provided with cable end sleeves.
– The Installation, electrical of the device may only be undertaken by technically trained personnel.

WARNING!

Danger of electric shock

In the event of an electrical accident, it must be possible to quickly disconnect the pump, and any electrical ancillaries which may possibly be present, from the mains.

– Install an emergency cut-off switch in the mains supply line to the pump and any electrical ancillaries which may be present or
– Integrate the pump and electrical ancillaries which may be present in the emergency cut-off management of the system and inform personnel of the isolating option.

WARNING!

Danger of electric shock

This pump is equipped with a protective earth conductor, to reduce the risk arising from an electric shock.

– Connect the PE conductor to "earth" with a clean and permanent electrical connection.

WARNING!

Danger of electric shock

A mains voltage may exist inside the pump housing.

– If the pump housing has been damaged, you must disconnect it from the mains immediately. It may only be returned to service after an authorised repair.

WARNING!

Warning about personal and material damage

EX pumps only: When operating in EX areas, certain subjects must be observed.

– The chapter "Important supplements for metering pumps in EX zones" of the "General Operating Instructions on ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories" must be observed in all cases.

CAUTION!

Warning about personal and material damage

Also observe the "General Operating Instructions for ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories"!

Personnel:

- Electrician

What requires electrical installation?

- motor
- External fan (option)
- Stroke control drive (Option)
- Stroke adjusting drive (Option)
- Diaphragm rupture sensor
- Overpressure sensor
- Stroke sensor (Option)
- Frequency converter (option)

motor

CAUTION!

Pump can be damaged

The pump can be damaged if the motor drives the pump in the wrong direction.

– When connecting the motor, pay attention to the correct direction of rotation indicated by the arrow on the fan cover, as shown in Fig. 17.

CAUTION!

The motor may be damaged

The motor is not equipped with a fuse.

– Install a suitable motor protection switch.

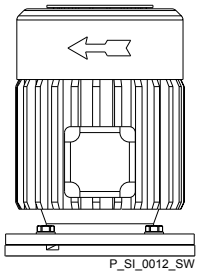

Fig. 17: Direction of rotation of motor

1. Use a suitable cable between the motor terminal box and power supply.
2. Install an emergency cut-off switch or include the motor in the emergency cut-off management of the system.

- *Key motor data can be found on the unit nameplate.*
- *Motor data sheets can be requested for more information.*
- *The terminal wiring diagram is located in the terminal box.*
- *Notes on the speed controlled motor with external fan and temperature monitoring can be found in the "General operating instructions for ProMinent® motor-driven metering pumps and hydraulic accessories"!*

The external fan requires an independent mains connection.

Stroke sensor (Option)

→ Connect the stroke sensor to a suitable monitoring device according to the details in the chapter "Technical Data". Also observe its technical data.

Other units

→ Install the other units according to their documentation.

9 Start up

Safety notes

WARNING!

Warning about personal and material damage

EX pumps only: When operating in EX areas, certain subjects must be observed.

– The chapter "Important supplements for metering pumps in EX zones" of the "General Operating Instructions on ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories" must be observed in all cases.

WARNING!

Hot surface

In event the power end motor is loaded excessively, its surface may become very hot.

– Avoid contact.
– If necessary, mount a guard plate.

CAUTION!

Possible environmental and material damage

The screw plug in the oil filler neck is factory-fitted and, during operation, prevents any pressure equalisation between the power end housing and the surroundings. This ensure that oil can be pushed from the power end housing.

– Replace the screw plug on the oil filler neck by the air vent plug supplied.
– Retain the sealing plug for subsequent transport of the unit.

CAUTION!

Single head version only: Oil may escape

The screw plug in the oil filler neck is factory-fitted and, during operation, prevents any pressure equalisation between the power end housing and the surroundings. This ensure that oil can be pushed from the power end housing.

– Ensure that the hole in the metal cap on the drive flange is always clear - see "Overview of equipment, control elements".

CAUTION!

Warning about personal and material damage

Also observe the "General Operating Instructions for ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories"!

CAUTION!

Danger due to incorrect use of the integral relief valve

The integral relief valve can only protect the motor and the gear, and then only against impermissible positive pressure that is caused by the metering pump itself. It cannot protect the system against positive pressure.

- Protect the motor and gear of the system against positive pressure using other mechanisms.
- Protect the system against illegal positive pressure using other mechanisms.

CAUTION!

Liquid end may be damaged

- If no hydraulic oil flows through the tube to the bleed valve, **immediately** switch off the pump and inform customer service.

Installing a vent screw

Replace the sealing screw at the oil filler neck with the supplied vent screw - see chapter "Overview of equipment and control elements".

Checking the oil level

When the pump is idle, check whether the pump oil level slightly covers the lower oil inspection window.

This indicates that the pump has not lost oil and consequently been damaged.

Checking the direction of rotation

When commissioning the unit, check whether the drive motor is rotating correctly - check this against the arrow on the motor housing or the diagram in the chapter entitled "Electrical Installation."

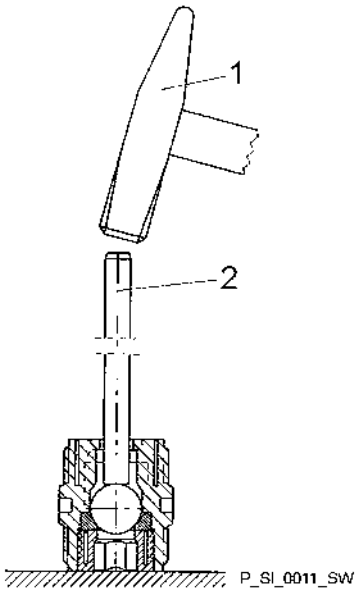

Fig. 18: Tapping the valve set disc

Eliminating suction problems (only for single ball valves with PTFE ball seat)

For suction problems occurring during start up:

- *Exclude the possibility that there are foreign bodies in the valve.*
- *Place the valve on a stable surface.*
- *Using a hammer (1) and a brass bar (2), gently tap the PTFE ball seat above the valve ball - see figure below.*
- *Then with the valve in a damp condition allow it to prime.*

Adjusting the stroke length

Only adjust the stroke length when the pump is running. This is easier and also better for the pump.

Correctly adjusting the pump:

- Select as large a stroke length as possible for viscous feed chemicals.
- Select as large a stroke length as possible for outgassing feed chemicals.
- Select as high a stroke rate as possible for good mixing.
- For precise metering using quantity-proportional metering, do not set the stroke length to less than 30 %.

Check the hydraulic oil flow

Check that shortly after switching on, some hydraulic oil flows through the tube to the bleed valve.

The pump can now be released for operation.

10 During use

WARNING!

Warning about personal and material damage

EX pumps only: When operating in EX areas, certain subjects must be observed.

– The chapter "Important supplements for metering pumps in EX zones" of the "General Operating Instructions on ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories" must be observed in all cases.

WARNING!

Personnel injury and material damage may occur

During use all units, protective equipment, additional devices must be fitted, operational and tightly closed.

WARNING!

Hot surface

In event the power end motor is loaded excessively, its surface may become very hot.

– Avoid contact.
– If necessary, mount a guard plate.

WARNING!

Sparking caused by dry running

If the bearings in the power end run dry, sparks can be formed.

– Check for oil leaks.
– When the pump is idle, the pump oil level must slightly cover the lower oil inspection window.

CAUTION!

Liquid end may be damaged

– If no hydraulic oil flows through the tube to the bleed valve, **immediately** switch off the pump and inform customer service.

Observe the instructions in the "Start up" chapter and the operating instructions for the other machine components.

11 Maintenance

Safety notes

WARNING!

Warning about personal and material damage

EX pumps only: When operating in EX areas, certain subjects must be observed.

– The chapter "Important supplements for metering pumps in EX zones" of the "General Operating Instructions on ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories" must be observed in all cases.

WARNING!

It is mandatory that you read the safety information and specifications in the "Storage, Transport and Unpacking" chapter prior to shipping the pump.

WARNING!

Hot surface

In event the power end motor is loaded excessively, its surface may become very hot.

– Avoid contact.
– If necessary, mount a guard plate.

WARNING!

Warning of hazardous or unknown feed chemical

Should a hazardous or unknown feed chemical be used, it may escape from the hydraulic components when working on the pump.

– Take appropriate protective measures before working on the pump (protective eyewear, protective gloves, ...). Read the safety data sheet on the feed chemical.
– Drain and flush the liquid end before working on the pump.

WARNING!

Risk of fingers being crushed

Under unfavourable conditions, the stroke axle or displacement body can cause crushing of the fingers.

– Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.

WARNING!

Risk of injury from the fan impeller

The fan impeller beneath motor's fan cowling can cause severe injuries while it is turning.

– The pump must only be connected to the mains voltage with the fan cowling closed.

CAUTION!

Warning of feed chemical spraying around

Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.

– Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
– Depressurise the system before commencing any work on hydraulic parts.

Maintenance work

Under heavy loading (e.g. continuous operation) shorter maintenance intervals are recommended than those given.

Keep a spare parts kit in stock ready for maintenance work.

Order numbers are contained on the CD.

Interval	Maintenance work
Quarterly*	EX pumps only: For special maintenance work see chapter "Important supplements for metering pumps in hazardous locations" of the "General Operating Instructions for ProMinent® motor-driven metering pumps and hydraulic accessories"
	Check the tightening torques for the dosing head screws (1) (30 Nm) and the turret flange screws (2) (19 Nm).
	Check that the discharge valve and suction valve are correctly seated.
	Check the correct seating and state of the metering lines at both discharge and suction ends.
	Check whether the diaphragm rupture sensor stops the pump or generates an alarm after it is triggered, see the chapter "Repairs".
	Check the tightness of the entire liquid end - particularly around the leakage hole!
	Check the oil level.
	Single head versions only: Check that the hole in the metal cap on the drive flange is clear - see the figure in the "Safety Chapter".
	Check that the electrical connections are intact
	Check whether the pump is transporting media correctly - run briefly at high power. Observe the maximum permissible operating pressure!

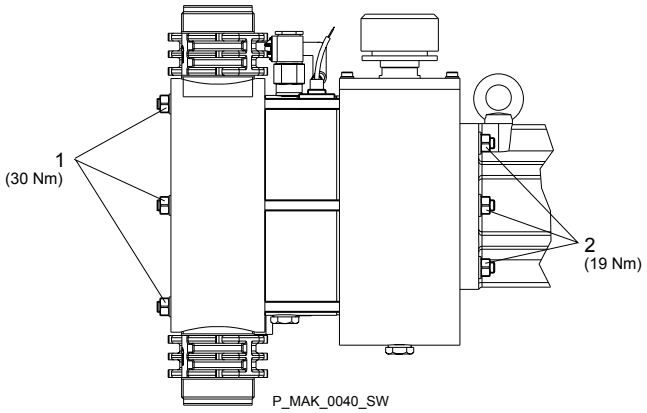

Fig. 19: Liquid end torques

1 Dosing head screws
2 Turret flange screws

Interval	Maintenance work
After approx. 5,000 operating hours	Change the gear oil.
	Change the hydraulic oil.
After approx. 10,000 operating hours **	Replace the diaphragm - refer to the "Repair" chapter - "Changing the diaphragm".

* Under normal loading (approx. 30 % of continuous operation)

Under heavy loading (e.g. continuous operation): Shorter intervals.

** under normal loading.

With very unfavourable metering parameters: Shorter intervals.

Changing the gear oil

WARNING!
Risk of burns due to hot gear oil
The gear oil may become very hot when the pump is heavily loaded

– When draining oil, avoid contact with the oil running out.

Gear oil

Gear oil	Supplied quantity	Part no.
Mobilgear 634 VG 460	20.0 l	1006284

Gear oil filling volumes

Types	Volume, approx.
All	16.5 l

Draining the gear oil:

1. Remove the vent screw (1).
2. Place an oil trough under the oil drain plug (2). Expected oil quantity - see filling volumes, above.
3. Unscrew the oil drain plug (2) out of the power end housing.
4. Allow the gear oil to run out of the power end.

5. Screw in the oil drain plug (2) with a new seal.

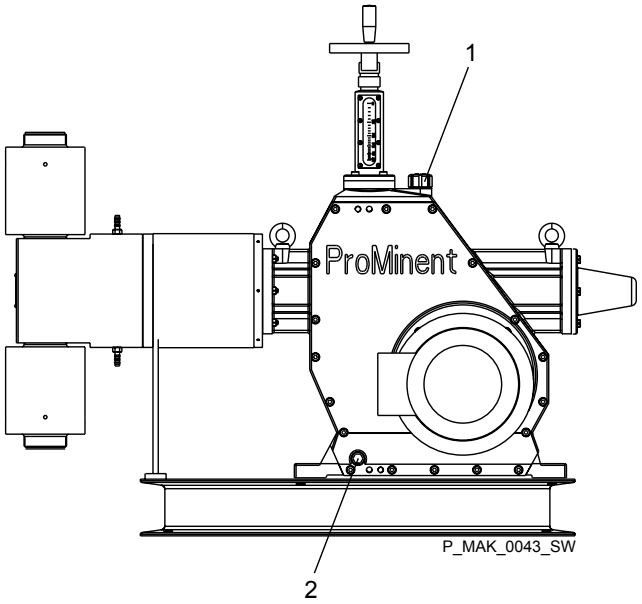

Fig. 20: Oil change 1

1 Vent screw
2 Oil drain plug

Filling with gear oil:

1. Start the pump.
2. Slowly pour gear oil through the vent screw (1) opening until the upper oil inspection window (3) is slightly covered.
3. Allow the pump to run for a further 1... 2 minutes.
4. Replace the vent screw (1).

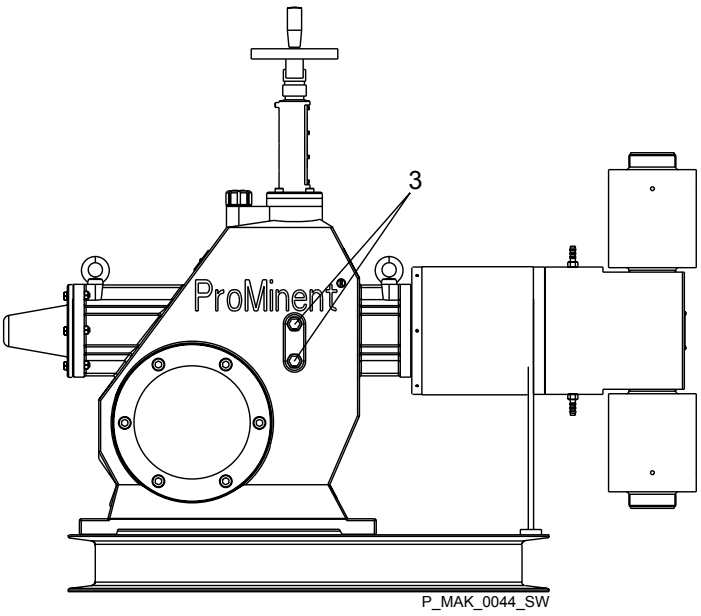

Fig. 21: Oil change 2

3 Oil inspection windows

Changing the hydraulic oil

WARNING!

Risk of burns due to hot hydraulic oil

The hydraulic oil may become very hot when the pump is exposed to extensive loading.

– When draining oil, avoid contact with the oil running out.

Instruction

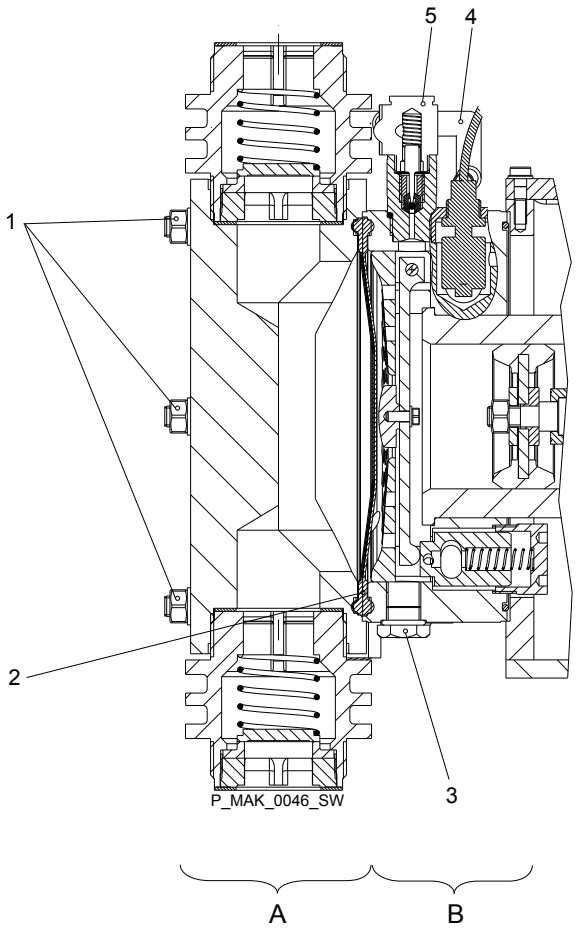

Fig. 22: Cross-section through the liquid end and hydraulic end

A Liquid end
B Hydraulic end
1 Nuts
2 Multi-layer diaphragm
3 Clear acrylic plug
4 Bleed hose
5 Bleed valve

1. Depressurise the suction and discharge lines as well as the liquid end.
2. Set the stroke length to 0 % stroke with the pump running.
3. Switch off the pump.
4. Secure the pump to prevent it being switched back on.
5. Place an oil trough under the hydraulic end.
6. Only drain the hydraulic oil from the hydraulic end via the clear acrylic plug (3) - see Fig. 22.

7. *No impurities must be allowed to enter the hydraulic end.*

   Screw the clear acrylic plug (3) back in and tighten slightly.

8. Pull the tube (4) from the bleed valve (5) and screw this out.

9. Not for types 103500 to 062305: Carefully remove the O-ring and the three filter meshes under the bleed valve (5).

   No dirt must get into the hydraulic end.

10. Push a very flexible tube (e.g. electricians' heat shrink tube) for aerating deep into the uncovered opening.

11. Slowly fill the hydraulic end via this opening using hydraulic oil up to the contact surface of the bleed valve.

    Filling volumes and ordering data - see next paragraph.

12. Clean the outside of the bleed valve (5) with compressed air.

13. Not for types 103500 and 062305: Insert the O-ring

14. Screw in the bleed valve (5).

15. Plug on the bleed hose (4).

16. Switch the pump on.

17. Set the desired stroke length.

18. When discharging against pressure, after a few minutes hydraulic oil must start to flow slowly through the tube to the bleed valve.

    CAUTION!
    The pump could be severely damaged.

    If a few minutes after switching on no hydraulic oil flows via the tube (4) to the bleed valve, immediately switch the pump off and inform customer service.

19. Run the pump against the pressure.

Hydraulic oil

Hydraulic oil	Supplied quantity	Part no.
Mobiloil DTE 10 Excel 15	1.0 l	555332

Hydraulic oil for low temperature applications

Hydraulic oil	Supplied quantity	Part no.
Esso Univis HVI 13	1.0 l	1027687

Hydraulic oil filling volumes

Types	Volume, approx.
	l
103500 to 062305:	1.4
All others:	0.65

12 Repairs

Safety notes

WARNING!

Warning about personal and material damage

EX pumps only: When operating in EX areas, certain subjects must be observed.

– The chapter "Important supplements for metering pumps in EX zones" of the "General Operating Instructions on ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories" must be observed in all cases.

WARNING!

It is mandatory that you read the safety information and specifications in the "Storage, Transport and Unpacking" chapter prior to shipping the pump.

WARNING!

Hot surface

In event the power end motor is loaded excessively, its surface may become very hot.

– Avoid contact.
– If necessary, mount a guard plate.

WARNING!

Warning of hazardous or unknown feed chemical

Should a hazardous or unknown feed chemical be used, it may escape from the hydraulic components when working on the pump.

– Take appropriate protective measures before working on the pump (protective eyewear, protective gloves, ...). Read the safety data sheet on the feed chemical.
– Drain and flush the liquid end before working on the pump.

WARNING!

Risk of fingers being crushed

Under unfavourable conditions, the stroke axle or displacement body can cause crushing of the fingers.

– Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.

WARNING!

Risk of injury from the fan impeller

The fan impeller beneath motor's fan cowling can cause severe injuries while it is turning.

– The pump must only be connected to the mains voltage with the fan cowling closed.

CAUTION!

Warning of feed chemical spraying around

Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.

- Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
- Depressurise the system before commencing any work on hydraulic parts.

12.1 Replacing the membrane

WARNING!

Observe the safety notes at the beginning of the chapter.

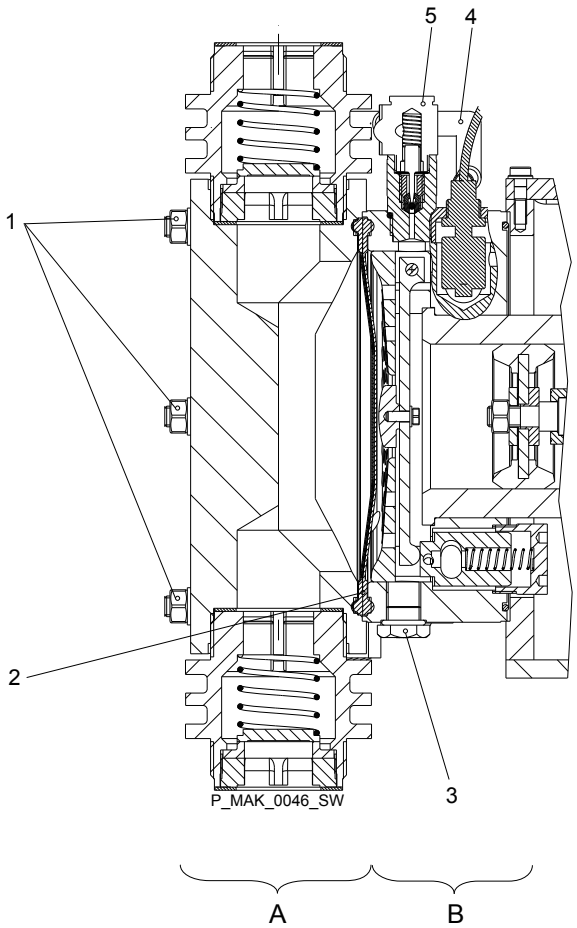

Fig. 23: Cross-section through the liquid end and hydraulic end

A Liquid end
B Hydraulic end
1 Nuts
2 Multi-layer diaphragm
3 Clear acrylic plug
4 Bleed hose
5 Bleed valve

1. Flush the suction line, discharge lines and liquid end (activate flushing equipment or immerse suction lance in a suitable medium and pump for a while (consider the effect of the medium on your system first!)) or proceed, as described below.
2. Set the stroke length to 0 % stroke with the pump running.
3. Switch off the pump.
4. Secure the pump to prevent it being switched back on.
5. If the liquid end has not been flushed according to the above processes, then protect yourself against the feed chemical - protective clothing, safety glasses, ...

   After dismantling immediately place parts that have been wetting with the medium in a trough with a suitable medium for flushing, in dangerous media were used flush and rinse thoroughly.
6. Loosen the union nuts or flange of the valves and detach the lines.
7. Drain the liquid end, flush as necessary.
8. Place an oil trough under the liquid end and hydraulic end.
9. Only drain the hydraulic oil from the hydraulic end via the clear acrylic plug (3) - see *on page 41*.
10. Remove the protective cover (5) from the backplate (6).
11. Screw the clear acrylic plug (3) back in and tighten slightly.
12. Remove the orange cover from the diaphragm rupture warning system by undoing the screws - see Fig. 24.
13. Undo the 6 nuts (1) at the liquid end (oil trough?).
14. Carefully pull the dosing head from the stud bolts

No impurities must be allowed to enter the hydraulic end.

15. Remove the diaphragm (3) (oil trough?).
16. Clean the sealing surfaces of the dosing head and the hydraulic end - if necessary use a suitable cleaning agent.
17. Trigger the diaphragm rupture sensor several times. It must trigger an alarm each time. If it does not, fit a new diaphragm rupture sensor!
18. Place the new diaphragm (3) with the light grey coating outwards at the hydraulic end.
19. Secure the orange cover of the diaphragm rupture warning system using the screws so that the diaphragm is held loosely in its position.
20. Push the dosing head on to the hydraulic end over the stud bolts (check the side recess on the dosing head is on the same side as the diaphragm rupture warning system?).
21. Check whether the diaphragm flap is positioned in the housing of the diaphragm rupture warning system so that it is free from distortion
22. Tighten the 6 nuts (1) at the dosing head in a crosswise manner (torque wrench!).

Tightening torque	30 Nm

23. Tightly screw the orange cover of the diaphragm rupture warning system into place.
24. Pull the tube (4) from the bleed valve (5) and screw this out.

25. Not for types 103500 to 062305: Carefully remove the O-ring and the three filter meshes under the bleed valve (5).

No dirt must get into the hydraulic end.

26. Push a very flexible tube (e.g. electricians' heat shrink tube) for aerating deep into the uncovered opening.

27. Slowly fill the hydraulic end via this opening using hydraulic oil up to the contact surface of the bleed valve.

Filling volumes and ordering data - see next paragraph.

28. Clean the outside of the bleed valve (5) with compressed air.

29. Not for types 103500 and 062305: Insert the O-ring

30. Screw in the bleed valve (5).

31. Plug on the bleed hose (4).

32. Loosen the union nut of the cable screw connection at the housing of the diaphragm rupture warning system.

33. Remove the housing from the diaphragm rupture warning system by undoing the screws.

34. Screw out the diaphragm rupture sensor by a couple of turns - see Fig. 24.

35. Slowly screw the diaphragm rupture sensor far enough in to cause it to switch.

36. Now slowly screw the diaphragm rupture sensor so far out that it closes - use a continuity tester - and then tighten the lock nut.

Do not fit the housing yet.

37. Reconnect the liquid end at both suction and discharge ends.

38. Switch the pump on.

39. Set the desired stroke length.

40. When discharging against pressure, after a few minutes hydraulic oil must start to flow slowly through the tube to the bleed valve.

CAUTION!

The pump could be severely damaged.

If a few minutes after switching on no hydraulic oil flows via the tube (4) to the bleed valve, immediately switch the pump off and inform customer service.

41. Run the pump against the pressure.

42. If the diaphragm rupture sensor opens with every stroke, screw it out until it just remains open and then tighten the lock nut.

43. Retighten the housing of the diaphragm rupture warning system by tightening the screws. Is the O-ring below correctly seated?

44. Tighten the union nut of the cable screw connection. It must be tight!

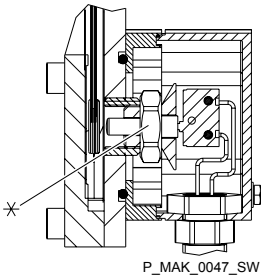

Fig. 24: Cross-section through the diaphragm rupture warning system

* Diaphragm rupture sensor

Hydraulic oil

Hydraulic oil	Supplied quantity	Part no.
Mobiloil DTE 10 Excel 15	1.0 l	555332

Hydraulic oil filling volumes

Types	Volume, approx.
	l
103500 to 062305:	1.4
All others:	0.65

12.2 Valve repair

Unsuitable spare parts for the valves may lead to problems for the pumps.

- *Only use new components that are especially adapted to fit your valve (both in terms of shape and chemical resistance).*
- *Use the correct spare part kits. In case of doubt, refer to the exploded views and ordering information contained in the "Supplementary information CD for ProMinent® pump operating instructions".*

Clean the discharge and suction valves only one after another as they cannot be differentiated using the arrow markings.

12.2.1 Double ball valves

Cleaning a discharge valve

Taking the discharge valve apart

1. Unscrew the discharge valve from the dosing head and rinse out.
2. Dismantle the discharge valve.
3. Rinse and clean all parts.
4. Replace the worn parts and seals.

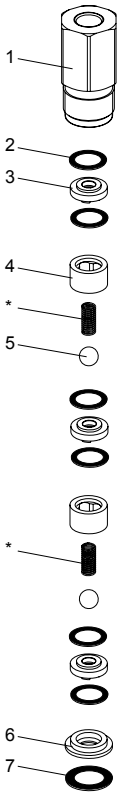

Fig. 25: Discharge valve (double ball valve).

Assembling the discharge valve

When assembling, take note of the orientation of the valve seats (3). The valve seats (3) are used as a ball seat on the fine machined side and as a ball cage and spring guide on the other side. The fine machined side must point in the flow direction with all valve seats.

When assembling the valves, take note of the sequence:

Teflon – Metal – Teflon – Metal - ...

1. Slide into the valve body (1) one after another:
   - one seal (2) and one valve seat (3) - correct!
   - one seal (2) and one valve bushing (4)
   - (If fitted: one spring (*) into the spring guide of the valve seat (3)
   - one ball (5) into the valve body (1)
   - one seal (2) and the second valve seat (3, correct!)
   - one seal (2) and the second valve bushing (4)
   - (If fitted: the second spring (*) into the spring guide of the valve seat (3))
   - the second ball (5) into the valve body (1)
   - one seal (2), the third valve seat (3) - (correct!) and a further seal (2)
2. Position the insert disc (6) with the flare on the packing.

   The distance between the edge of the valve body and the insert disk (6) is due to the construction.
3. Place the larger seal (7) between the insert disk (6) and the dosing head.
4. Screw in the valve until the stop.

Cleaning a suction valve

A suction valve is dismantled, cleaned and assembled in the same way as a discharge valve.

Please note, however, that when assembling, the valve seat (3) must be aligned in the other direction. The fine machined side must point in the flow direction with all valve seats (3).

12.2.2 Single ball valves

1. Screw the valve cap (5) on to the suction side - see .
2. Carefully remove the parts from the valve body (2).
3. Replace the worn parts.
4. Clean the remaining parts.
5. Check all parts.
6. If available: Place the compression spring inside the valve body (2).
7. Insert the valve ball (3 and the valve seat (4).
8. Screw on the valve cap (5).

Pay attention to the flow direction of the discharge and suction connectors when fitting the valve.

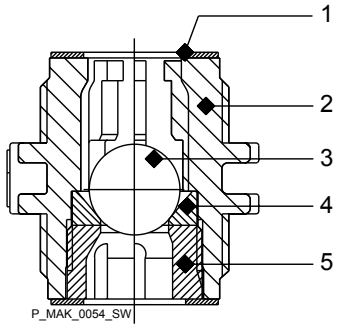

Fig. 26: Cross-section through the single ball valve

1 Seal
2 Valve body
3 Valve ball
4 Valve seat
5 Valve cap

12.2.3 Plate valves

Do not scratch the finely machined sealing surfaces on the valve plates (5) and valve inserts (6).

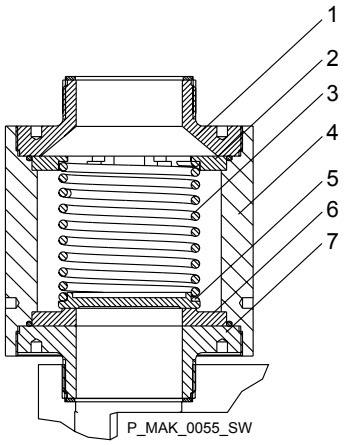

Fig. 27: Section through a plate valve (DN65 shown)

1 Valve cap II (only DN 65)
2 Perforated disc (only DN 65)
3 Compression spring
4 Valve body
5 Valve plate
6 Valve insert
7 Valve cap

1. Screw the valve cap (7) on to the suction side - see .
2. Carefully remove the parts from the valve body (4).
3. Replace the worn parts.
4. Clean the remaining parts.
5. Check all parts.

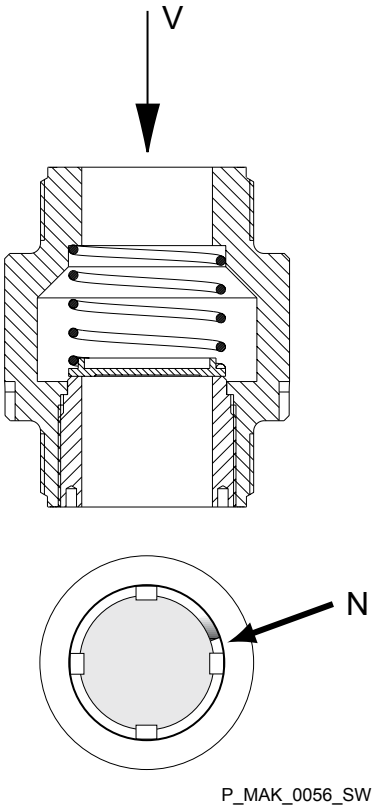

Fig. 28: Inserting the compression spring

6. Only DN 65: Insert the perforated disc (2) in the valve body (4).
7. Place the compression spring (3) inside the valve body (4).

Position the compression spring with the end (see figure: arrow N, at the bottom) as shown on one of the lugs in the valve body.

Otherwise the valve plate may knock when in operation.

8. Insert the valve plate (5) and the valve insert (6).
9. Screw on the valve cap (7).

Pay attention to the flow direction of the discharge and suction connectors when fitting the valve.

M5Ha_066000 ... 062305 P, PP, PTFE only: Tighten the fastening nuts of the valve mounting flange at the dosing head in a crosswise pattern (12 Nm).

13 Troubleshooting

Safety notes

WARNING!

Warning about personal and material damage

EX pumps only: When operating in EX areas, certain subjects must be observed.

– The chapter "Important supplements for metering pumps in EX zones" of the "General Operating Instructions on ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories" must be observed in all cases.

WARNING!

Fire danger

Only with combustible media: These may start to burn when combined with oxygen.

– When filling and draining the liquid end, the feed chemical must not come into contact with oxygen.

WARNING!

Hot surface

In event the power end motor is loaded excessively, its surface may become very hot.

– Avoid contact.
– If necessary, mount a guard plate.

WARNING!

Danger of an electric shock

Personnel working on electrical parts can be electrocuted if all electrical lines carrying current have not been disconnected.

– Disconnect the supply cable before working on the motor and prevent it from being reconnected accidentally.
– Any separately driven fans, servo motors, speed controllers or diaphragm rupture sensors fitted should also be disconnected.
– Check that the supply cables are de-energised.

WARNING!

Warning of hazardous or unknown feed chemical

Should a hazardous or unknown feed chemical be used, it may escape from the hydraulic components when working on the pump.

– Take appropriate protective measures before working on the pump (protective eyewear, protective gloves, ...). Read the safety data sheet on the feed chemical.
– Drain and flush the liquid end before working on the pump.

WARNING!

Risk of injury from the fan impeller

The fan impeller beneath motor's fan cowling can cause severe injuries while it is turning.

– The pump must only be connected to the mains voltage with the fan cowling closed.

CAUTION!

Warning of feed chemical spraying around

Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.

– Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
– Depressurise the system before commencing any work on hydraulic parts.

Tasks

Fault description	Cause	Remedy	Personnel
Pump does not prime in spite of full stroke motion and bleeding	The valves are dirty or worn.	Repair the valves - see chapter entitled "Repair".	Technical personnel
Pump does not reach high pressure rates.	The valves are dirty or worn.	Repair the valves - see chapter entitled "Repair".	Technical personnel
	The feed chemical has particles larger than 3 mm.	Install a suitable filter in the suction line.	Technical personnel
	Insufficient hydraulic oil in the power end.	Refill with hydraulic oil until the oil inspection window is 1/3 covered - see "Changing the diaphragm" in the chapter "Repair".	Instructed personnel
	The motor is wired incorrectly.	1. Check the mains voltage and mains frequency. 2. Wire the motor correctly.	Electrician
	The mains voltage has failed.	Eliminate the cause.	Electrician
	Operating diaphragm ruptured and alarm has not sounded.	■ Replace the operating diaphragm immediately - refer to the "Repair" chapter - "Changing the diaphragm".	Technical personnel
The diaphragm rupture warning system generates an alarm.	The operating diaphragm has ruptured.	■ Replace the operating diaphragm immediately - refer to the "Repair" chapter - "Changing the diaphragm". ■ Check the diaphragm rupture warning system for correct operation.	Technical personnel
No hydraulic oil flows through the tube at the bleed valve	- - - -	Immediately switch off the pump and inform customer service.	
The power end motor is very hot.	The discharge line is seriously constricted.	■ Rectify any constriction of the discharge line. ■ Have the safety relief valve checked.	Technical personnel
All other faults.	Other causes.	Call ProMinent® or ProMaqua® service.	

14 Decommissioning and disposal

14.1 Decommissioning

WARNING!

Warning about personal and material damage

EX pumps only: When operating in EX areas, certain subjects must be observed.

– The chapter "Important supplements for metering pumps in EX zones" of the "General Operating Instructions on ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories" must be observed in all cases.

WARNING!

Danger of an electric shock

When working on the motor or electrical auxiliary equipment, there is a danger of an electric shock.

– Before working on the motor, take note of the safety instructions in its operating instructions!
– Should external fans, servomotors or other auxiliary equipment be installed, these should also be disconnected and checked that they are voltage free.

WARNING!

Danger from chemical residues

There is normally chemical residue in the liquid end and on the housing after operation. This chemical residue could be hazardous to people.

– It is mandatory that the safety note relating to the "Storage, Transport and Unpacking" chapter is read before shipping or transporting the unit.
– Thoroughly clean the liquid end and the housing of chemicals and dirt. Adhere to the safety data sheet for the feed chemical.

WARNING!

Warning of hazardous or unknown feed chemical

Should a hazardous or unknown feed chemical be used, it may escape from the hydraulic components when working on the pump.

– Take appropriate protective measures before working on the pump (protective eyewear, protective gloves, ...). Read the safety data sheet on the feed chemical.
– Drain and flush the liquid end before working on the pump.

CAUTION!

Warning of feed chemical spraying around

Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.

– Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
– Depressurise the system before commencing any work on hydraulic parts.

WARNING!

Hot oil and hot components

The hydraulic oil and the hydraulic end may become very hot when the pump is exposed to heavy loading.

– Allow the pump to cool before starting work.

CAUTION!

Danger of damage to the device

The device can be damaged by incorrect and improper storage or transportation.

– Take into account the information in the "Storage, Transport and Unpacking" chapter if the system is decommissioned for a temporary period.

Final decommissioning

Personnel: ■ Technical personnel

1. Disconnect the pump from the mains power supply.
2. Depressurise and bleed the hydraulic system around the pump.
3. Flush the liquid end with a suitable medium - Observe the safety data sheet! Flush the dosing head thoroughly when using hazardous feed chemicals!
4. Drain the hydraulic oil - see chapter "Maintenance". There are 2 discharge screws!
5. Drain the gear oil - refer to the chapter entitled "Maintenance".
6. Thoroughly clean the liquid end and the housing of chemicals and dirt.
7. Possible additional work - see chapter "Storage, Transport and Unpacking".

Temporary decommissioning

In addition:

1. Place the caps on the valves.
2. Push the caps into place on the tube nozzles.
3. Preferably place the pump on a pallet.
4. Cover the pump with a tarpaulin cover - allowing rear ventilation!
5. Store the pump is a dry, sealed place under storage conditions according to the chapter "Storage, Transport and Unpacking".

14.2 Disposal

Personnel: ■ Technical personnel

CAUTION!

Environmental hazard due to hydraulic oil

The pump contains hydraulic oil, which can cause damage to the environment.

– Drain the hydraulic oil from the pump.
– Note the local guidelines currently applicable in your country!

CAUTION!

Environmental hazard due to gear oil

The pump contains gear oil, which can cause damage to the environment.

– Drain the gear oil from the pump.
– Note the local guidelines currently applicable in your country!

CAUTION!

Note the local guidelines generally currently applicable in your country!

15 Technical data

Only for "M - modified" version:

WARNING!

Risk of personal injuries

Please observe the ”Supplement for modified version“ at the end of the chapter!

It replaces and supplements the technical data!

15.1 Performance data

Main pumps with motor 1500 rpm under 50 Hz operation

Type	Minimum pump capacity at maximum back pressure			Maximum stroke rate	Suction lift	Connector size	Shipping weight*	Piston Ø
	bar	l/h	ml/stroke	Strokes/min	m WS	G-DN	kg	mm
250450	25	450	125	60	3	G 2-32	320	60
250562	25	562	125	75	3	G 2-32	320	60
250772	25	772	125	103	3	G 2-32	320	60
250997	25	997	125	133	3	G 2-32	320	60
251170	25	1170	125	156	3	G 2-32	320	60
160616	16*	616	171.2	60	3	G 2 1/4-40	320	70
160770	16*	770	171.2	75	3	G 2 1/4-40	320	70
161058	16*	1058	171.2	103	3	G 2 1/4-40	320	70
161366	16*	1366	171.2	133	3	G 2 1/4-40	320	70
161602	16*	1602	171.2	156	3	G 2 1/4-40	320	70
120716	12*	716	199	60	3	G 2 1/4-40	320	75
120895	12*	895	199	75	3	G 2 1/4-40	320	75
121229	12*	1229	199	103	3	G 2 1/4-40	320	75
121588	12*	1588	199	133	3	G 2 1/4-40	320	75
121862	12*	1862	199	156	3	G 2 1/4-40	320	75
120919	12*	919	255.3	60	3	G 2 1/4-40	320	85
121148	12*	1148	255.3	75	3	G 2 1/4-40	320	85
121577	12*	1577	255.3	103	3	G 2 1/4-40	330	85
122037	12*	2037	255.3	133	3	G 2 1/4-40	320	85
122389	12*	2389	255.3	156	3	G 2 1/4-40	320	85
101345	10	1345	374	60	3	G 2 3/4-50	330	100
101680	10	1680	374	75	3	G 2 3/4-50	330	100
102310	10	2310	374	103	3	G 2 3/4-50	330	100
102980	10	2980	374	133	3	G 2 3/4-50	330	100
103500	10	3500	374	156	3	G 2 3/4-50	330	100
62305	6	2305	641	60	3	Flange DN65**	330	130
62880	6	2880	641	75	3	Flange DN65**	330	130
63960	6	3960	641	103	3	Flange DN65**	330	130
65110	6	5110	641	133	3	Flange DN65**	330	130
66000	6	6000	641	156	3	Flange DN65**	330	130

*** Material version PPT/PCT/TTT max. 10 bar**

**** SST version with G 2 1/2“**

The permissible priming pressure at the suction side is 2 m WS.

All figures refer to water at 20 °C.

The suction lift applies to filled suction line and filled liquid end - when installed correctly.

The priming lift of 2 m applies for clean and moistened valves and a clear outlet

Main pumps with motor 1800 rpm under 60 Hz operation

Type	Minimum pump capacity at maximum back pressure			Maximum stroke rate	Suction lift	Connector size	Shipping weight*	Piston Ø
	bar	l/h	ml/stroke	Strokes/min	m WS	G-DN	kg	mm
250450	362	537	142	72	3	G 2-32	320	60
250562	362	671	177	89	3	G 2-32	320	60
250772	362	922	244	123	3	G 2-32	320	60
250997	362	1191	315	159	3	G 2-32	320	60
251170	-	-	-	-	3	G 2-32	320	60
160616	232*	736	195	72	3	G 2 1/4-40	320	70
160770	232*	920	243	89	3	G 2 1/4-40	320	70
161058	232*	1264	334	123	3	G 2 1/4-40	320	70
161366	232*	1633	432	159	3	G 2 1/4-40	320	70
161602	-	-	-	-	3	G 2 1/4-40	320	70
120716	174*	855	226	72	3	G 2 1/4-40	320	75
120895	174*	1069	283	89	3	G 2 1/4-40	320	75
121229	174*	1469	389	123	3	G 2 1/4-40	320	75
121588	174*	1898	502	159	3	G 2 1/4-40	320	75
121862	-	-	-	-	3	G 2 1/4-40	320	75
120919	174*	1098	290	72	3	G 2 1/4-40	320	85
121148	174*	1372	363	89	3	G 2 1/4-40	320	85
121577	174*	1885	499	123	3	G 2 1/4-40	330	85
122037	174*	2435	645	159	3	G 2 1/4-40	320	85
122389	-	2856	754	-	3	G 2 1/4-40	320	85
101345	145	1607	425	72	3	G 2 3/4-50	330	100
101680	145	2008	532	89	3	G 2 3/4-50	330	100
102310	145	2761	731	123	3	G 2 3/4-50	330	100
102980	145	3562	943	159	3	G 2 3/4-50	330	100
103500	-	-	-	-	3	G 2 3/4-50	330	100
62305	87	2755	730	72	3	Flange DN65**	330	130
62880	87	3443	912	89	3	Flange DN65**	330	130
63960	87	4734	1254	123	3	Flange DN65**	330	130
65110	87	6108	1618	159	3	Flange DN65**	330	130
66000	-	-	-	-	3	Flange DN65**	330	130

* Material version PPT/PCT/TTT max. 145 psi

** SST version with G 2 1/2“

The permissible priming pressure at the suction side is 2 m WS.

All figures refer to water at 20 °C.

The suction lift applies to filled suction line and filled liquid end - when installed correctly.

The priming lift of 2 m applies for clean and moistened valves and a clear outlet

15.2 Accuracy

15.2.1 Reproducibility

Data	Value	Unit
Reproducibility	±1	% *

* for measurements taken under constant conditions, minimum 10 % stroke rate and water at 20 °C - when installed correctly, p< 1 bar

15.2.2 Metering precision

Data	Value	Unit
Metering precision	±1	% *

* at maximum stroke length and maximum back pressure

15.3 Viscosity

The liquid ends are generally suitable for the following viscosity ranges:

Version	Range	Unit
no valve springs	0 ... 200	mPas
with valve springs	200 ... 500	mPas
with appropriately laid out installation	500 ... 1000	mPas
with appropriately laid out installation and advice from ProMinent	> 1000	mPas

* Only when the installation is correctly adjusted

15.4 Wetted materials

DN 32 / DN 50 / DN 65 plate valves

Material version	Liquid end	Suction/discharge connector	Seals	Valve plates / valve spring	Valve seat
PPT	Polypropylene	Polypropylene	PTFE	Hast. C	PTFE
PCT	PVC	PVC	PTFE	Hast. C	PTFE

Material version	Liquid end	Suction/discharge connector	Seals	Valve plates / valve spring	Valve seat
TTT	PTFE with carbon	PTFE with carbon	PTFE	Hast. C	PTFE
SST	Stainless steel 1.4571//1.44041.4404	Stainless steel 1.45711.4404	PTFE	Hast. C	PTFE

Patented, vacuum packed, multi-layer diaphragm.

DN 40 plate valves

Material version	Liquid end	Suction/discharge connector	Seals	Valve plates / valve spring	Valve seat
PPE	Polypropylene	Polypropylene	EPDM	Hast. C	PTFE
PCA	PVC	PVC	Viton®	Hast. C	PTFE
TTT	PTFE with carbon	PTFE with carbon	PTFE	Hast. C	PTFE
SST	Stainless steel 1.4571//1.4404	Stainless steel 1.45711.4404	PTFE	Hast. C	PTFE

Patented, vacuum packed, multi-layer diaphragm.

Viton® is a registered trademark of DuPont Dow Elastomers.

15.5 Ambient conditions

15.5.1 Temperatures

Pump, compl.

Data	Value	Unit
Storage and transport temperature	-10 ... +50	°C
Ambient temperature in operation (drive + motor):	-10 ... +40	°C

PC liquid end

Data	Value	Unit
Max. temperature long-term at max. operating pressure	45	°C
Max. temperature for 15 min at max. 2 bar	60	°C
Minimum temperature	-10	°C

PP liquid end

Data	Value	Unit
Max. temperature long-term at max. operating pressure	60	°C
Max. temperature for 15 min at max. 2 bar	100	°C
Minimum temperature	-10	°C

TT liquid end

Data	Value	Unit
Max. temperature long-term at max. operating pressure	90	°C

Data	Value	Unit
Max. temperature for 15 min at max. 2 bar	120	°C
Minimum temperature	-10	°C

SST liquid end

Data	Value	Unit
Max. temperature long-term at max. operating pressure	90	°C
Max. temperature for 15 min at max. 2 bar	120	°C
Minimum temperature	-10	°C

15.5.2 Air humidity

Data	Value	Unit
Maximum air humidity *:	95	% rel. humidity

*non-condensing (according to DIN IEC 60068-2-30)

15.6 Housing degree of protection

Data	Value
Protection against contact and humidity*	IP 55

*according to DIN VDE 470 (EN IEC 60529)

15.7 Stroke sensor (option), intrinsically safe

Namur sensor (identity code specification "Stroke sensor": 1)

Install the sensor according to the chapter "Installation, electrical".

Namur sensor (Specified for EX zones)

5–25 V DC, in accordance with Namur or DIN 19234, potential-free design.

Data	Value	Unit
Rated voltage *	8	VDC
Power consumption - active surface uncovered	> 3	mA
Power consumption - active surface covered	< 1	mA
Rated switching distance	1.5	mm

* Ri ~ 1 kΩ

Cable colour	Polarity
blue	-
brown	+

15.8 Diaphragm rupture sensor

Install the sensor according to the chapter "Installation, electrical".

Electrical data

Parameter	value
Switch output	0.1 A, 250 V AC
Contact type	NC (micro switch)
Degree of protection	IP67

Cable conductor assignments

Cable colour	Polarity
blue	-
brown	+

For safety reasons we recommend connecting to a protective low voltage, e.g. in accordance with EN 60335-1 (SELV).

15.9 Overpressure sensor

Install the sensor according to the chapter "Installation, electrical".

Electrical data

Parameter	value
Switch output	10 W / 12 VA
Switching current	0.5 A
Switching voltage	48 V
Contact type	NC (reed switch)
Degree of protection	IP67

Cable conductor assignments

Cable colour	Polarity
blue	-
brown	+

For safety reasons we recommend connecting to a protective low voltage, e.g. in accordance with EN 60335-1 (SELV).

15.10 Filling volumes

15.10.1 Gear oil

Gear oil

Gear oil	Supplied quantity	Part no.
Mobilgear 634 VG 460	20.0 l	1006284

Required amount of oil

Pump type	Oil change, compl.
All:	16.5 l

15.10.2 Hydraulic oil

Hydraulic oil

Hydraulic oil	Supplied quantity	Part no.
Mobiloil DTE 11	1.0 l	555332

Required amount of oil

Pump type	Diaphragm replace-ment	Oil change, compl.
103500 ... 062305:	approx. 1.4 l	approx. 5.0 l
All others:	approx. 0.65 l	approx. 2.6 l

15.11 Sound pressure level

Sound pressure level

Sound pressure level LpA < 75 dB in accordance with EN ISO 20361:2010-10

at maximum stroke length, maximum stroke rate, maximum back pressure (water)

15.12 Compatibility

The hydraulic accessories of the Makro/ 5 metering pump Hydro are compatible with the Sigma and Makro TZ piston pumps.

The connecting dimensions of valves and dosing heads are the same size but have different materials. (This does not apply with different diaphragm materials).

15.13 Supplement for modified versions

(With Identcode specification "Version": "M" - "modified")

Technical data

Technical data of pumps in the modified version can deviate from those of the standard pumps. They can be queried by stating the details of the serial number.

motor

The motor data sheets for the modified version are valid. They may deviate from the standard motor data sheets.

Spare parts

With a modified version, it is absolutely necessary to specify the details of the serial number requesting and ordering the spare and replacement parts.

16 EC Declaration of Conformity

For pumps without explosion protection:

- Original -
EC Declaration of Conformity for Machinery

We,

ProMinent Dosiertechnik GmbH
Im Schuhmachergewann 5 - 11
DE - 69123 Heidelberg

hereby declare that the product specified in the following complies with the relevant basic health and safety rules of the EC Directive, on the basis of its functional concept and design and in the version marketed by us.
This declaration loses its validity in the event of a modification to the product not agreed with us.

Description of the product:	***Metering pump, Makro 5 series***
Product type:	***M5Ma..., M5Ka..., M5Ha...***
Serial no.:	***Please refer to nameplate on the device***
Relevant EC Directives:	***EC - Machinery Directive (2006/42/EC)*** ***EC EMC Directive (2004/108/EC)*** ***The safety objectives of the Low Voltage Directive 2006/95/EC are complied with*** ***in accordance with Appendix I, No. 1.5.1*** ***of the Machinery Directive 2006/42/EC***
Harmonised standards applied, in particular:	***EN ISO 12100, EN 809,*** ***EN ISO 13732-1, EN 60034-5, EN 60034-6, EN 60034-9,*** ***EN 60204-1, EN 61000-6-2, EN 61000-6-3***
Technical documents have been compiled by documentation specialists:	***Norbert Berger*** ***Im Schuhmachergewann 5-11*** ***DE-69123 Heidelberg***
Date / Manufacturer's signature:	*05/10/2011*
Details of the signatory:	*Joachim Schall, Head of Development*

For pumps with explosion protection:

The EC Declaration of Conformity for pumps for potentially explosive atmospheres is enclosed with the pump.

The EC Declaration of Conformity, the EC type-test reports and the operating instructions for the individual components are also enclosed with the pump.

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